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(54) Structural unit for flow-technical apparatuses or machines

(57) The structural unit (1) according to the invention is made up from juxtaposed and interconnected elementary structures (2) having at least one surface (4) which from a flow-technical point of view is identical with a part of the final surface (3) of the structural unit (1).

The elementary structures may be secured to each other by riveting, adhesives or welding and included internal reinforcing elements, stressed-skin construction, or a foamed synthetic material interior.

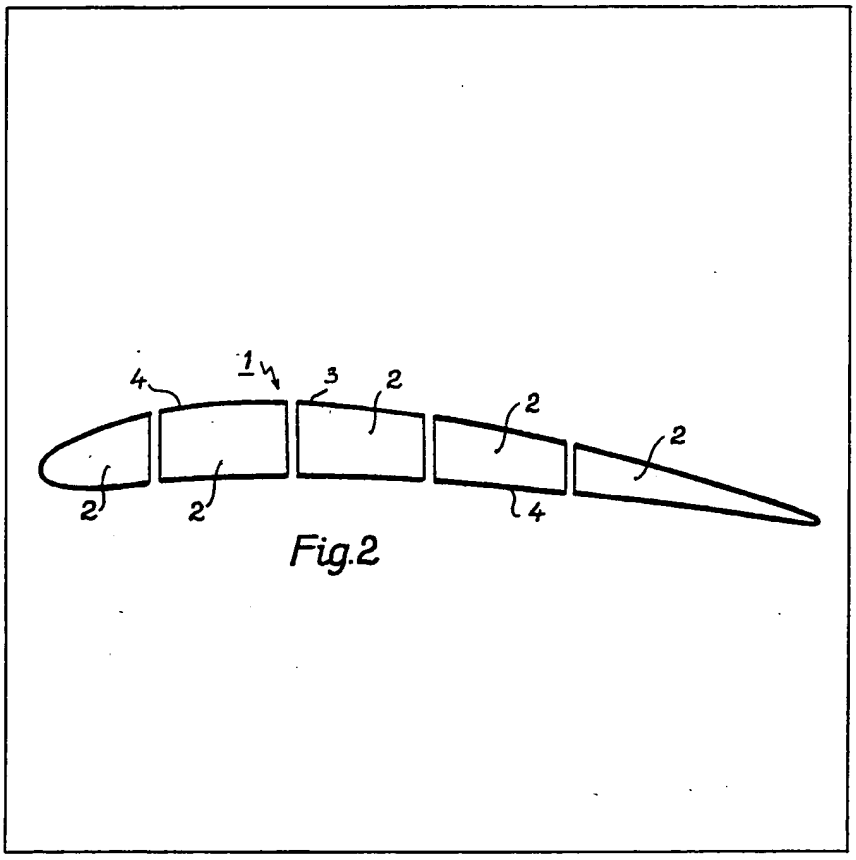

Fig.2

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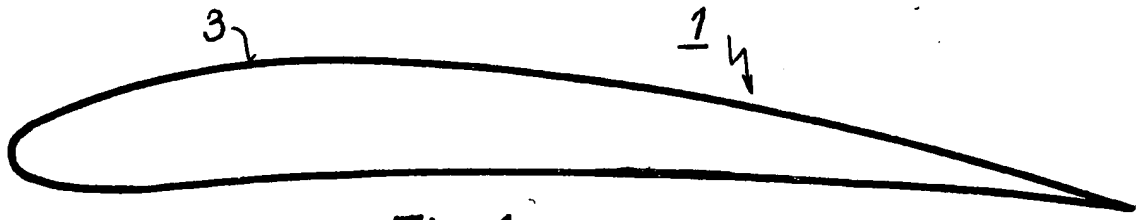


Fig.1

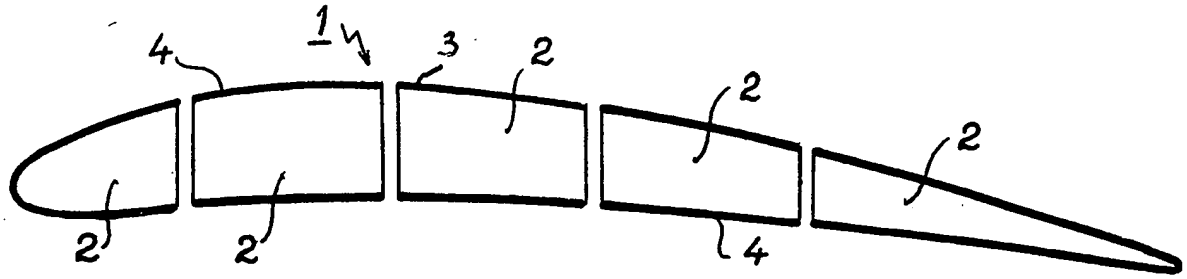


Fig.2

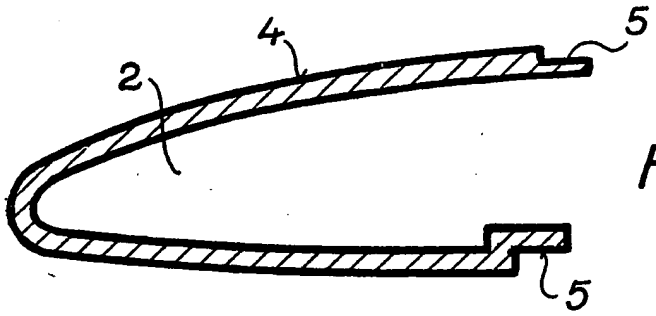
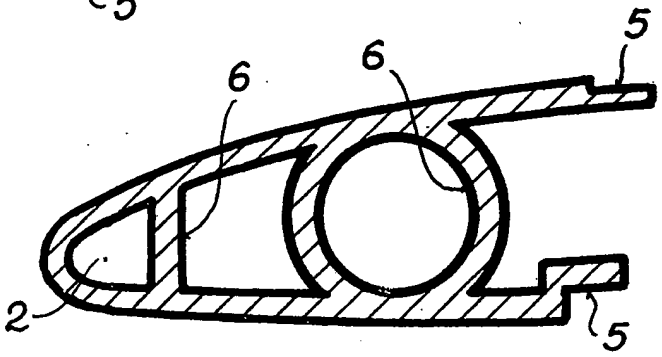


Fig.3

Fig.4



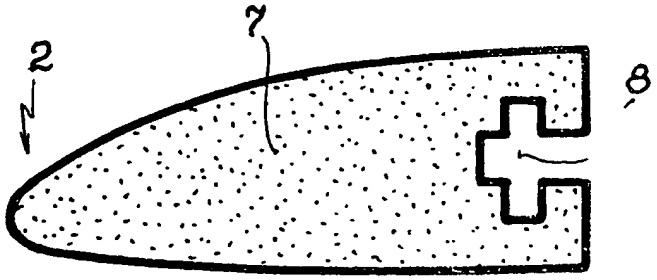


Fig.5

SPECIFICATION

Structural unit for flow-technical apparatuses or machines

The invention relates to a structural unit for flow-technical apparatuses and machines, having specific shape or profile from an aerodynamic or rheological point of view. Such structural unit may be, for instance, a fan or blower blade or wing. The possibility for application of the invention generally arises in the field of air flow machinery, e.g. pumps, turbines, fans, various flow-guiding devices, ventilating apparatus, aviation engineering and others.

It is known that the structural units of fixed cross-section and shape, as for instance the various fan wings or turbine blades are difficult to produce in large sizes. If the wing of a blower or fan used in cooling towers is taken as an example, evidently its production assuring the optimal shape of the wing from an aerodynamic point of view will be extremely difficult. In the case of smaller machines such structural units are machined from solid material, or a rough piece will be produced, for instance, by metal casting. In case of larger structural units a lattice frame is first made and is then provided with a surface covering sheet or plate.

This latter method is used particularly in the production of the wings of aeroplanes.

No matter which production method is taken as example, the correct shape can be attained only with complicated technology, low productivity high labour input, and consequently at high cost.

The invention is aimed at simplification, standardisation and application of the size series principle, in the production of structural units in flow-technical apparatuses or machines having specific shapes from a rheological point of view.

The aim of the invention is sought to be attained by the structural unit being itself built up from elementary structures (elements) provided with predetermined external surfaces, which in their juxtaposition form the final surface of the structural unit. Applying suitable "family" (size series) principles, structural units of varying shape and size can be assembled from a stock of sets of elementaty structures.

A connection of the elementary structures to each other can be realised either with releasable jointing elements, or with non-releasable (permanent) jointing elements. Generally, jointing by adhesive bonding or welding is preferred. Also riveting may be considered, or fixing with interconnecting pieces, such as grooves and matching counterpieces, engaging pins, or engaging strips.

The material of the elementary structures may be metal, synthetic materials e.g. semi-finished products of metal and synthetic materials of varying cross-section; wood; foamed plastics.

The elementary structures may be simple stressed-skin structures, or may be provided with internal reinforcement; elementary structures filled in, for instance, with foamed synthetic material may also be used. The elementary structures may be formed from extruded, drawn or pressed semi-finished products, e.g. by cutting.

Thus, a structural unit according to the invention comprises interconnected elementary structures each of which has at least one surface which from a flow-technical point of view is identical with a part of the final surface of the structural unit.

Each elementary structure according to the invention may be regarded as a part derived from cutting up the final structural unit. Accordingly, in the majority of cases each elementary structure has two surfaces which will form part of the final surface of the structural unit to be assembled. Naturally, the surface of the prefabricated elementary structure will not be suitable in every case for the intended structural unit and the final surface will have to be provided with some kind of cover, e.g. by coating, painting, lacquering, etc. From the flow-technical point of view however, at least one surface of the prefabricated elementary structures shall form part of the surface of the final structural unit.

The structural unit according to the invention is described, purely by way of example, with reference to the accompanying diagrammatic drawing, Illustrating a structural unit in the form of a fan wing, and wherein:

Figure 1 illustrates the profile of the wing,

Figure 2 illustrates the ventilator wing divided into elementary structures,

Figure 3 is an embodiment of an elementary structure of the structural unit, shown in cross-section,

Figure 4 is a cross-section of another embodiment of an elementary structure, and

Figure 5 is a section of a further embodiment of the elementary structure.

The fan or ventilator wing 1 has an external contour defined by surface 3. The surface 3 determines the profile essential from an aerodynamic or flow-technical point of view. The ventilator wing 1 in Figure 2 is divided into five elementary structures 2. The elementary structures 2 may be prefabricated individually and when suitably interconnected will give the aerofoil or wing shape shown in Figure 1. At least one surface 4 of each elementary structure shall form part of the aerodynamically decisive or important whole surface of the wing 1 as the structural unit.

The elementary structures 2 may be formed from shell or stressed-skin structures, as shown in Figure 3. For jointing of the stressed-skin structures flanges 5 are used, along which the adjacent elementary structures 2 can be bonded or welded together, or possibly fastened by rivets. Surfaces 4 of the elementary structures 2 jointly determine the aerodynamically important surface of the wing 1, although the surfaces 4 — following the jointing of the elementary structures 2 — will be provided with some kind of covering layer.

Figure 4 shows an elementary structure in which reinforcing elements in the form of curved internal ribs and straight ribs 6 are used. These elementary structures 2 are also fitted together by

way of flanges 5, along which the jointing of the elementary structures may be assured.

Figure 5 illustrates an elementary structure 2 the interior of which is of foamed synthetic material 7. In connection with this embodiment a method of fastening the elementary structures is different: a groove 8 is formed on one of the elementary structures, while the adjacent elementary structure is provided with a counterpiece (not shown) complementary in shape to that of the groove 8. Said counterpiece may consist of one or several projections.

Forming families or dimensionally related sets of elementary structures 2 is readily achievable with this invention, for the purpose of allowing the assembly of structural units of varying size and shape from the different elementary structures 2. In this way, a large number of structural units can be produced, differing from each other both in respect of profile (shape) and size. By a suitable application of the mentioned family principle even embodiments twisted along one of the axes of the structural unit may be produced.

CLAIMS

1. Aerodynamic structural unit for flow machinery having a predetermined shape or profile e.g. a ventilator wing, said unit being made up of juxtaposed and interconnected elementary structures, at least one surface of each of which is flow-technically (aerodynamically) identical or coincident with a part of the final surface of the structural unit.

2. A structural unit as claimed in claim 1, wherein at least some of said elementary structures are provided with internal reinforcement.

3. A structural unit as claimed in claim 1 or 2, wherein the interior of said elementary structures is filled with a space-filling material, e.g. foamed synthetic material.

4. A structural unit as claimed in any preceding claim, wherein the elementary structures are fastened to each other by adhesive bonding or welding.

5. A structural unit as claimed in any preceding claim, wherein the elementary structures are provided with interengageable, complementary recess(es) and projection(s).

6. A structural unit according to claim 1, substantially as herein described with reference to Figures 1 and 2, in combination with Figure 3 or Figure 4 or Figure 5 of the accompanying drawing.

7. Sets of elementary structures of varying shapes and sizes interconnectable to form aerodynamic structural units according to any preceding claim.

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